

Complete Summary

GUIDELINE TITLE

Radiologic investigation of patients with hematuria.

BIBLIOGRAPHIC SOURCE(S)

Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Sandler RA, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Radiologic investigation of patients with hematuria. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 6 p. [28 references]

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous published version: Radiologic investigation of patients with hematuria. Reston (VA): American College of Radiology (ACR); 2001. 5 p. (ACR appropriateness criteria). [22 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT
CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Hematuria

GUIDELINE CATEGORY

Evaluation
Screening

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Nephrology
Radiology
Urology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of radiologic examinations in the investigation of patients with hematuria

Note: This guideline is limited to adults and does not refer to patients whose hematuria coexists with other clinical situations reviewed in other ACR Appropriateness Criteria topics, including acute trauma, infection, renal failure, symptoms of acute stone disease, known renal masses, and prostatism. It is also limited to initial tests; follow-up in cases of normal or abnormal first tests is beyond its scope.

TARGET POPULATION

Adult patients with hematuria

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray
 - Kidney, intravenous urography, intravenous pyelogram (IVP)
 - Kidney, pyelography retrograde
 - Abdomen, kidneys, ureters, bladder (KUB)
 - Chest
2. Computed tomography (CT)
 - Kidney, urography
 - Abdomen and pelvis
 - Bladder, high resolution, virtual cystoscopy
3. Ultrasound (US), kidney and bladder, transabdominal
4. Magnetic resonance imaging (MRI)
 - Kidney, urography
 - Abdomen and pelvis
5. Invasive (INV), kidney, angiography
6. Urinary tract scintigraphy
7. Virtual cystoscopy

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in investigation of patients with hematuria

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching

agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by the Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Hematuria

Variant 1: All patients except those with generalized renal parenchymal disease or young females with hemorrhagic cystitis.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-ray, kidney, intravenous urography, IVP	8	
CT, kidney, urography	8	
US, kidney and bladder, transabdominal	6	May miss ureteral and urothelial lesions; abdomen x-ray, retrograde pyelography, and cystoscopy are useful adjuncts.
X-ray, kidney, pyelography retrograde	5	
MRI, kidney, urography	4	
CT, abdomen and pelvis	4	CT may follow IVP or US if initial findings are ambiguous.
INV, kidney, angiography	4	Rarely, vascular malformations may cause hematuria and require angiography for diagnosis.
X-ray, abdomen, KUB	2	It is assumed that an abdomen film will be part of the indicated IVP. If an IVP is not performed, KUB may be performed along with US.
MRI, abdomen and pelvis	2	
Urinary tract scintigraphy	2	
Virtual cystoscopy	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Due to generalized renal parenchymal disease.

Radiologic Exam Procedure	Appropriateness Rating	Comments
---------------------------	------------------------	----------

Radiologic Exam Procedure	Appropriateness Rating	Comments
US, kidney and bladder, transabdominal	8	For renal volume and morphology and as localizer for biopsy.
X-ray, chest	6	For cardiopulmonary and pleural manifestations of renal diseases.
X-ray, kidney, pyelography retrograde	3	
CT abdomen and pelvis	2	Routine
INV, kidney, angiography	2	
MRI, abdomen and pelvis	2	
Urinary tract scintigraphy	2	
CT, kidney, urography	2	
MRI, kidney, urography	2	
CT, bladder, high resolution, virtual cystoscopy	2	
X-ray, abdomen, KUB	1	
X-ray, kidney, intravenous urography, IVP	1	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Hemorrhagic cystitis in females less than 40 years old (hematuria completely clears with therapy).

Radiologic Exam Procedure	Appropriateness Rating	Comments
---------------------------	------------------------	----------

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT abdomen and pelvis	2	This and other imaging are rarely needed for diagnosis. Routine.
Urinary tract scintigraphy	2	
MRI, abdomen, pelvis	2	
INV, kidney, angiography	2	
CT, kidney, urography	2	
MRI, kidney, urography	2	
X-ray, pyelography retrograde	2	
CT, kidney, high resolution, virtual cystoscopy	2	
X-ray, kidney, intravenous urography, IVP	1	
X-ray, abdomen, KUB	1	
US, kidney and bladder, transabdominal	1	
<p style="text-align: center;">Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate</p>		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Hematuria is one of the most common presentations of patients with urinary tract diseases and of patients referred for urinary imaging. This review summarizes practice for the radiologic approach to such patients. It is limited to adults and does not refer to patients, whose hematuria coexists with other clinical situations reviewed in other ACR Appropriateness Criteria topics, including acute trauma, infection, renal failure, symptoms of acute stone disease, known renal masses, and prostatism. It is also limited to initial tests; follow-up of normal or abnormal first tests is beyond its scope.

The initial decision to be made is whether all patients with any degree of hematuria need imaging evaluation. Patients whose urinary tracts have no detectable abnormalities normally release small amounts of blood into the urine, so that several red cells per high-power field may be seen upon microscopic examination of the spun sediment. This fact, together with the low prevalence of clinically detectable disease in some groups of patients with asymptomatic microscopic hematuria, has led some investigators to suggest that minimal microhematuria in an asymptomatic young adult needs no evaluation. Unfortunately, no threshold number of red blood cells per high-power field has been found that separates patients with clinically important disease from those with no detectable urinary tract abnormalities. The distinction between gross and microscopic hematuria is not a useful guideline to distinguish between patients who need evaluation and those who do not, and the ranges of red cells per high-power field in patients with "normal" hematuria and those in whom microhematuria indicates important or even life-threatening disease have sufficient overlap that many authorities claim that any amount of hematuria, no matter how slight, should be considered an indication of urinary tract malignancy until proven otherwise, and that all cases of hematuria therefore need complete work-up.

There may, however, be specific circumstances in which complete radiologic work-up is not necessary. Young women with a clinical picture of simple cystitis and whose hematuria completely and permanently resolves after successful therapy can probably be spared any imaging. Patients who have clear-cut evidence of glomerulopathy also constitute a special group; although they should probably have chest radiography to search for any of the numerous manifestations of glomerulonephritis (including cardiac enlargement, pleural and pericardial effusions, pulmonary congestion and edema, and pulmonary bleeding) and ultrasound (to display the size and number of kidneys prior to biopsy and to screen for renal morphologic abnormalities that may coexist by chance in a patient with glomerulonephritis), they probably do not need extensive work-up to exclude a surgical lesion that may be bleeding. However, the decision to pursue this course requires firm demonstration that the glomerular abnormality is responsible for the bleeding; such evidence includes heavy proteinuria (sufficient to indicate that plasma proteins, rather than proteins in red cells, account for the protein in the urine), red cell casts, or (in institutions that have reliable traditions of identifying such abnormalities) evidence of severe red cell dysmorphism. Patients on anticoagulants have a sufficiently high prevalence of important disease that work-up cannot be forgone.

All other adult patients -- especially those specifically referred for evaluation of hematuria -- require imaging evaluation. This evaluation will almost always be accompanied by cystoscopy, since many bleeding urinary tract lesions arise in the lower tract and no imaging procedure is highly sensitive in diagnosing most of them. It goes without saying that a complete history, physical examination, urine analysis, and appropriate serologic tests should precede or accompany the imaging examinations. At the time of cystoscopy, bilateral retrograde pyelography is often employed to evaluate the upper tracts for pathology.

There is not universal agreement about the first imaging examination to choose. Traditionally, excretory urography (IVP) was standard, but the establishment of this practice preceded the development of high-quality ultrasound, CT, and MRI.

Subsequently, real-time ultrasound was investigated and found to be useful in the search for bleeding urinary tract lesions. Very recently, a combination of urinary tract CT with various ways of obtaining IVP-like images of the collecting systems, ureters, and bladder has been proposed, as have similar formats of MRI examinations (CT urography and MR urography). (Urinary tract scintigraphy possesses insufficient spatial resolution to screen for any but large intrarenal or obstructing lesions.)

There is some literature dealing with the choice between ultrasound and excretory urography as the initial imaging study for patients with hematuria. With respect to the wide range of abnormalities that may be encountered in such patients (including urinary tract neoplasms of all sorts, stone disease, inflammatory processes, congenital abnormalities, vascular lesions, and obstruction from a wide variety of lesions), both exams are felt to have moderately high sensitivity. Precise comparisons of the two are lacking for several reasons: false-negative rates have not been evaluated in large numbers of patients due to the cost and invasiveness of the follow-up procedures that would be necessary; sensitivities need to be individually evaluated for each of the many kinds of lesions, so that a careful comparative study would require thousands of patients for appropriate statistical power; and there has been little careful definition of the patient groups in whom the two modalities have been compared. Nevertheless, it appears that there are only slight differences between the two modalities with regard to the rate of diagnosing clinically important lesions. Ultrasound and urography tend to miss different sorts of lesions. Ultrasound is not likely to detect nonobstructing ureteral stones or small urothelial abnormalities, and urography with nephrotomography may miss small exophytic anterior and posterior renal masses and small bladder lesions. The choice of exam may be affected by clinical circumstances (a positive urinary cytologic analysis may make urography crucial, whereas serious risk factors for contrast reactions may make ultrasound more appropriate). When ultrasound is negative and the source of hematuria remains obscure, urography should be added; if urography is negative, CT (or ultrasound) may be ordered. When ultrasound is used as the primary screening modality, the yield from imaging may be increased by adding a plain film of the abdomen.

CT of the entire urinary tract can be augmented by images of the contrast-opacified collecting systems, ureters and bladder; the combined exam is known as CT urography. The IVP-like portions of the exam may be obtained by exposing film (or direct digital) images when contrast administered for the CT has opacified the hollow urinary organs. Images may alternatively be produced by reformatting delayed CT images to show this anatomy. Presumably, the pyelogram portion of this exam could be comparable to a standard IVP exam, and the CT should be more sensitive and specific (both statistically and pathologically) than ultrasound or nephrotomography with regard to focal renal parenchymal abnormalities. For these reasons, a distinction should be made between routine CT of the abdomen and pelvis that may not be optimized for the urinary tract and a dedicated CT urogram that is tailored to evaluate the urinary tract for sources of hematuria. The latter study typically employs oral water instead of oral positive contrast media. A noncontrast CT of the kidneys is obtained to evaluate renal calculi. This is followed by the injection of iodinated contrast media with the acquisition of a high-resolution (1-2 mm thick sections) nephrographic phase and high-resolution delayed (5-10 minutes) phase. The latter can be reconstructed to evaluate the urinary tract and bladder. Some investigators employ a hybrid of CT urography

and IVP-like delayed images to form one complete study, which is also known as CT urography. CT urography, taken as a group, has shown equal or superior sensitivity to IVP for causes of hematuria.

MR urography currently serves as an alternative imaging technique for children and pregnant women and for patients with a contraindication to iodinated contrast media. It has the potential to be useful in the search for important abnormalities that cause hematuria. Initial work demonstrating the feasibility of its performance has been published. But the examination has not been adopted in clinical practice, is expensive, and has not been evaluated for efficacy, so it cannot be recommended as an initial examination.

Several authors have suggested that virtual cystoscopy, the acquisition of high-resolution CT images reconstructed to allow virtual "fly-throughs" of bladder, be used to evaluate the bladder for causes of hematuria. Virtual cystoscopy is inaccurate for small lesions and lesions located near the ureteric orifices. The urethra cannot be evaluated. Thus, while promising, virtual cystoscopy cannot replace actual cystoscopy.

In summary, most adults with hematuria of any degree require urinary tract imaging. Glomerulopathies may be appropriately investigated with renal ultrasound and chest radiography; most other patients require urography, CT urography, or ultrasound and a few carefully chosen patients may need no imaging at all.

Abbreviations

- CT, computed tomography
- INV, invasive
- IVP, intravenous pyelogram
- KUB, kidneys, ureters, bladder
- MRI, magnetic resonance imaging
- US, ultrasound

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures of patients with hematuria

Subgroups Most Likely to Benefit

- Patients with clear-cut evidence of glomerulopathy
- Patients on anticoagulants

POTENTIAL HARMS

- Ultrasound is not likely to detect nonobstructing ureteral stones or small urothelial abnormalities.
- Urography with nephrotomography may miss small exophytic anterior and posterior renal masses and small bladder lesions.
- Virtual cystoscopy is inaccurate for small lesions and lesions located near the ureteric orifices.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Sandler RA, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Radiologic investigation of patients with hematuria. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 6 p. [28 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1995 (revised 2005)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Urologic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Peter L. Choyke, MD (Panel Chair); Edward I. Bluth, MD; William H. Bush, Jr, MD; David D. Casalino, MD; Isaac R. Francis, MD; S. Zafar H. Jafri, MD; Akira Kawashima, MD, PhD; Alan Kronthal, MD; Robert A. Older, MD; Nicholas Papanicolaou, MD; Parvati Ramchandani, MD; Arthur T. Rosenfield, MD; Carl Sandler, MD; Arthur J. Segal, MD; Clare Tempany, MD; Martin I. Resnick, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous published version: Radiologic investigation of patients with hematuria. Reston (VA): American College of Radiology (ACR); 2001. 5 p. (ACR appropriateness criteria). [22 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

ACR Appropriateness Criteria® Anytime, Anywhere™ (PDA application). Available from the [ACR Web site](#).

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI on September 7, 2004. The updated information was verified by the guideline developer on October 8, 2004. This summary was updated by ECRI on February 7, 2006.

COPYRIGHT STATEMENT

Instructions for downloading, use, and reproduction of the American College of Radiology (ACR) Appropriateness Criteria® may be found on the [ACR Web site](#).

DISCLAIMER

NGC DISCLAIMER

The National Guideline Clearinghouse™ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at <http://www.guideline.gov/about/inclusion.aspx>.

NGC, AHRQ, and its contractor ECRI make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.

© 1998-2006 National Guideline Clearinghouse

Date Modified: 10/9/2006

